

What is claimed is:

1. A method of manufacturing a semiconductor device, comprising:

forming an insulating layer on a semiconductor substrate;

forming a contact hole on the insulating layer;

depositing a barrier metal layer in the contact hole and on the insulating layer using an atomic layer deposition process; and

performing the atomic layer deposition process a plurality of times to produce a barrier metal layer having a desired thickness.
2. The method according to claim 1, wherein the barrier metal layer is a tungsten nitride layer.
3. The method of claim 1, further comprising:

performing a deposition process to deposit a tungsten layer to fill the contact hole.
4. The method according to claim 3, wherein the barrier metal layer is a tungsten nitride layer.
5. The method of claim 4, wherein the tungsten nitride layer and the tungsten layer are in-situ deposited in a reaction chamber.
6. The method of claim 4, wherein the tungsten nitride layer and the tungsten layer are in-situ deposited in a reaction chamber for depositing the tungsten layer.
7. The method of claim 5, wherein the reaction chamber is maintained at a pressure of 10 to 350 Torr.

8. The method of claim 5, wherein the reaction chamber is maintained at a temperature of 250 to 550°C.
9. The method of claim 2, wherein said depositing the tungsten nitride layer comprises:
depositing a silicon single atomic layer in the contact hole;
forming a tungsten single atomic layer; and
forming the tungsten nitride layer by plasma-processing the tungsten single atomic layer.
10. The method according to claim 9, wherein the silicon single atomic layer is deposited using SiH₄ gas.
11. The method of claim 10, wherein the SiH₄ gas is injected at a flow rate of 5 to 200 SCCM.
12. The method according to claim 9, wherein the tungsten single atomic layer is formed using WF₆ gas, wherein the silicon of the silicon single atomic layer reacts with WF₆ gas.
13. The method of claim 12, wherein the WF₆ gas is injected at a flow rate of 5 to 200 SCCM.
14. The method of claim 9, wherein the tungsten nitride layer is formed by plasma-processing the tungsten single atomic layer using nitrogen gas.
15. The method of claim 1, wherein the barrier layer has a total thickness of 3 to 100 Å.
16. The method of claim 2, wherein the tungsten nitride layer has a total thickness of 3 to 100 Å.